

REMARKS

Claims 1-18 stand rejected on prior art grounds. Claims 1, 5, 7, 13, 15, and 17 are amended herein without introducing new matter. Claims 8 and 16 are canceled herein without prejudice or disclaimer. Therefore, claims 1-7, 9-15, 17, and 18 are all the claims pending in the application. This amendment is being made, in part, based on telephonic conferences between the Examiner and the undersigned attorney on July 26-28, 2004. Applicants respectfully traverse these rejections based on the following discussion.

I. The Prior Art Rejections

Claims 1-18 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Honma et al. (U.S. Patent No. 6,596,086), hereinafter referred to as "Honma", in view of Hoshina et al. (U.S. Patent No. 5,785,764), hereinafter referred to as "Hoshina". Additionally, claims 1-18 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Zhao et al. (U.S. Patent No. 5,968,379), hereinafter referred to as "Zhao", in view of Hoshina. Claims 7-12, 14-16 and 18 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Zhao in view of Yuichiro et al. (JP 07074114), hereinafter referred to as "Yuichiro". Applicants respectfully traverse these rejections based on the following discussion.

Honma teaches in an apparatus for vapor phase growth of silicon single crystal thin films, in-plane uniformity of susceptor temperature is improved and film thickness of a silicon single crystal thin film is uniformized. The base material of a lift pin 8 provided in a pocket 5a of a susceptor 5 is changed to a base material lower in thermal conductivity than a base material of the susceptor 5, by which local decreases in susceptor temperature in the vicinity of the lift pin are prevented. As the base material of the lift pin 8, SiC, carbon of a desired grade and quartz

are preferred.

Hoshina teaches a susceptor 1 for a gas phase growth apparatus to which a round depressed pocket 2 with a bottom a side wall is formed for the placing of a semiconductor wafer 3 wherein a protuberance 6 is provided on the circumference of the pocket at and near the position where the semiconductor wafer touches the side wall 4 of the pocket 2 in such a way that the protuberance 6 covers a part of a chamfered area of the semiconductor wafer 3 without touching it. Thus, cracks and breakage due to adhesion between a susceptor and a wafer may be prevented.

Zhao teaches systems, methods, and an apparatus for depositing titanium films at rates up to 200 Å/minute on semiconductor substrates from a titanium tetrachloride source. A ceramic heater assembly with an integrated RF plane for bottom powered RF capability allows PECVD deposition at a temperature of at least 400°C for more efficient plasma treatment. A thermal choke isolates the heater from its support shaft, reducing the thermal gradient across the heater to reduce the risk of breakage and improving temperature uniformity of the heater. A deposition system incorporates a flow restrictor ring and other features that allow a 15 liters/minute flow rate through the chamber with minimal backside deposition and minimized deposition on the bottom of the chamber, thereby reducing the frequency of chamber cleanings, and reducing clean time and seasoning. Zhao also teaches deposition and cleaning processes.

Yuichiro teaches a susceptor for supporting a wafer has a wafer pocket 2 provided with tiny projections 7, about 2 mm high, on its lower wall 4. Using this susceptor for epitaxial growth of 15-wafer batches, the empirical results of 600 pieces are: 5 with some bridges and 595 completely acceptable, i.e., 99% yield. This proves that the projections 7 serve to avoid bridges by maintaining point contacts of the wafer with the wall of the wafer pocket so that process gas

may not stagnate.

However, the claimed invention, as provided in amended independent claims 1, 7, and 15 contain features, which are patentably distinguishable from the prior art references of record. Specifically, claim 1 recites, in part, "...wherein said projections have a beveled edge, such that an acute angle greater than 80 degrees occurs between said lower surface (of said pocket) and said beveled edge..." and claims 7 and 15 similarly recite in part, "wherein an acute angle greater than 80 degrees occurs between said lower surface and said beveled edge." As admitted by the Examiner during the above-referenced telephonic conferences, and in particular, during the telephonic conference on July 27, 2004, the prior art does not teach or suggest a device having an acute angle between the lower surface and the beveled edge being greater than 80 degrees. The issue raised by the Examiner during the telephonic conference on July 27, 2004 was the criticality of the angle.

In fact, the angle configuration (greater than 80 degrees) is quite critical to the claimed invention, and is not merely a design choice. The claimed invention provides an apparatus/susceptor which is utilized in wafer processing, and in particular in heavy volume wafer processing. As such, manufacturing speed and efficiency are central to use of the claimed invention in heavy volume wafer processing. Thus, the lifting pin provided by the claimed invention aids in speeding the wafer processing as opposed to manual lifting or lifting by an unattached and/or incongruous mechanism. However, the device in Hoshina does not provide lifting pins, and as such is suggestive of not being incorporated in heavy wafer processing, and while the device in Honma appears to teach lift pins, suggesting use in heavy wafer processing, it would not be logical or obvious to combine Honma with Hoshina because each is directed to a different type of wafer processing scheme (i.e., heavy volume wafer processing vs. non-heavy

volume wafer processing). Nonetheless, even if Honma were to be legally combined with Hoshina, they would still fail to teach all of the elements of the claimed invention, particularly that the angle configuration between the lower surface of the pocket and the beveled edge of the projection being greater than 80 degrees.

Hoshina clearly states, in col. 3, lines 23-28, col. 5, lines 6-12, and col. 7, lines 10-15 that the angle is in the range of 40-80 degrees, and preferably in the range of 60-75 degrees. However, such a range of angles would be unworkable for the claimed invention to function properly. This is so because using any angle less than 80 degrees would result in severe wafer errors (such as WOOPS errors as described on page 1 of the Applicants' specification. In fact, empirical data gathered by the Applicants further illustrates this, wherein the data was gathered based on visual inspections of wafer edges after loading and unloading of wafers in a susceptor (as would be used in heavy volume wafer processing). In order to test the results achieved by prior art devices, different angle configurations were tested including angles of 45 and 60 degrees. For 45 degree angles, out of 50 instances of loading/unloading of wafers in a susceptor, the results showed two broken wafers and 33 wafers with edge marks (scratches). At 60 degrees, the results showed one broken wafer and 24 wafers with edge marks (scratches).

In non-heavy volume wafer processing, the susceptor may be positioned sufficiently level, such that it does not move (i.e., through vibrations, etc.). However, in most conventional heavy volume wafer processing susceptors, due to the speed at which these devices operate, vibrational forces tend to shift the susceptor causing it to become non-leveled, which may cause the wafer to slide slightly on one side of the susceptor, which then causes the wafer to be in contact with two beveled retainers. In this case, the angle of the retainers is extremely critical. If the angle is less than 80 degrees, as demonstrated during the loading/unloading tests (when the

wafer being lifted from the pocket), scratches result on the edge of the wafer due to excessive contact/friction between wafer and retainers. This creates foreign material generation and can result in wafer failure (i.e., wafer breakage). Therefore, the retainer angle is very critical and must be greater than 80 degrees for the device to function properly. In fact, experimental testing performed on the apparatus/susceptor provided by the claimed invention illustrated that all wafer transfers (loading/unloading testing) were friction free (i.e., no scratches or breakage) at angles greater than 80 degrees.

In fact, the criticality of the angle provided by the claimed invention would not be obvious to one of ordinary skill in the art, who may be a technician overseeing the wafer processing, given that the prior art, namely Hoshina, provides a preferable range of an angle between 60 and 75 degrees. Thus, one of ordinary skill in the art would have clearly read Hoshina to provide the preferable parameters of a susceptor device, and without undue experimentation, would have used these preferable parameters in constructing a similar device. However, the Applicants determined that using conventional devices still resulted in wafer errors (i.e., WOOPS errors), and determined that the angle between the lower surface of the pocket and the beveled edge of the projection was in fact critical and that this angle had to be greater than 80 degrees to overcome a very challenging problem long sought to be solved in the industry; that of wafer error reduction and elimination, especially in heavy volume wafer processing.

With regard to the rejections based on Zhao in combination with either Hoshina or Yuichiro, the independent claims have been amended to overcome these rejections by including language pertaining to the critical angle feature of the beveled edge of the projection. Moreover, the arguments presented above for Honma in view of Hoshima follow the similar rejections of Zhao in view of Hoshina and Zhao in view of Yuichiro, and in the interest of brevity these

arguments are not provided to avoid redundancy.

In view of the foregoing, the Applicants respectfully submit that the cited prior art references, Honma in view of Hoshina, Zhao in view of Hoshina, and Zhao in view of Yuichiro, do not teach or suggest the features defined by amended independent claims 1, 7, and 15 and as such, claims 1, 7, and 15 are patentable over Honma, Hoshina, Zhao, and Yuichiro. Further, dependent claims 2-6, 9-14, 17, and 18 are similarly patentable over Honma, Hoshina, Zhao, and Yuichiro, not only by virtue of their dependency from patentable independent claims, respectively, but also by virtue of the additional features of the invention they define.

Moreover, the Applicants note that all claims are properly supported in the specification and accompanying drawings, and no new matter is being added. In fact, the incorporation of the amended language (angle being greater than 80 degrees) is derived from original claims 5, 13, and 17 (now amended), and as such this amended language should not constitute new matter for the purposes of conducting a new search. That is, the search previously conducted by the Examiner covered the aspects taught in original claims 5, 13, and 17, and by incorporating such language into the independent claims should not and does not constitute new matter. As such, the Applicants are respectfully requesting that the Examiner consider and enter this amendment. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections.

II. Formal Matters and Conclusion

With respect to the rejections to the claims, the claims have been amended, above, to overcome these rejections. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections to the claims.

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In view of the foregoing, Applicants submit that claims 1-7, 9-15, 17, and 18, all the claims presently pending in the application, are patentably distinct from the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary. Please charge any deficiencies and credit any overpayments to Attorney's Deposit Account Number 09-0456.

Respectfully submitted,

Dated: 7/28/04



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